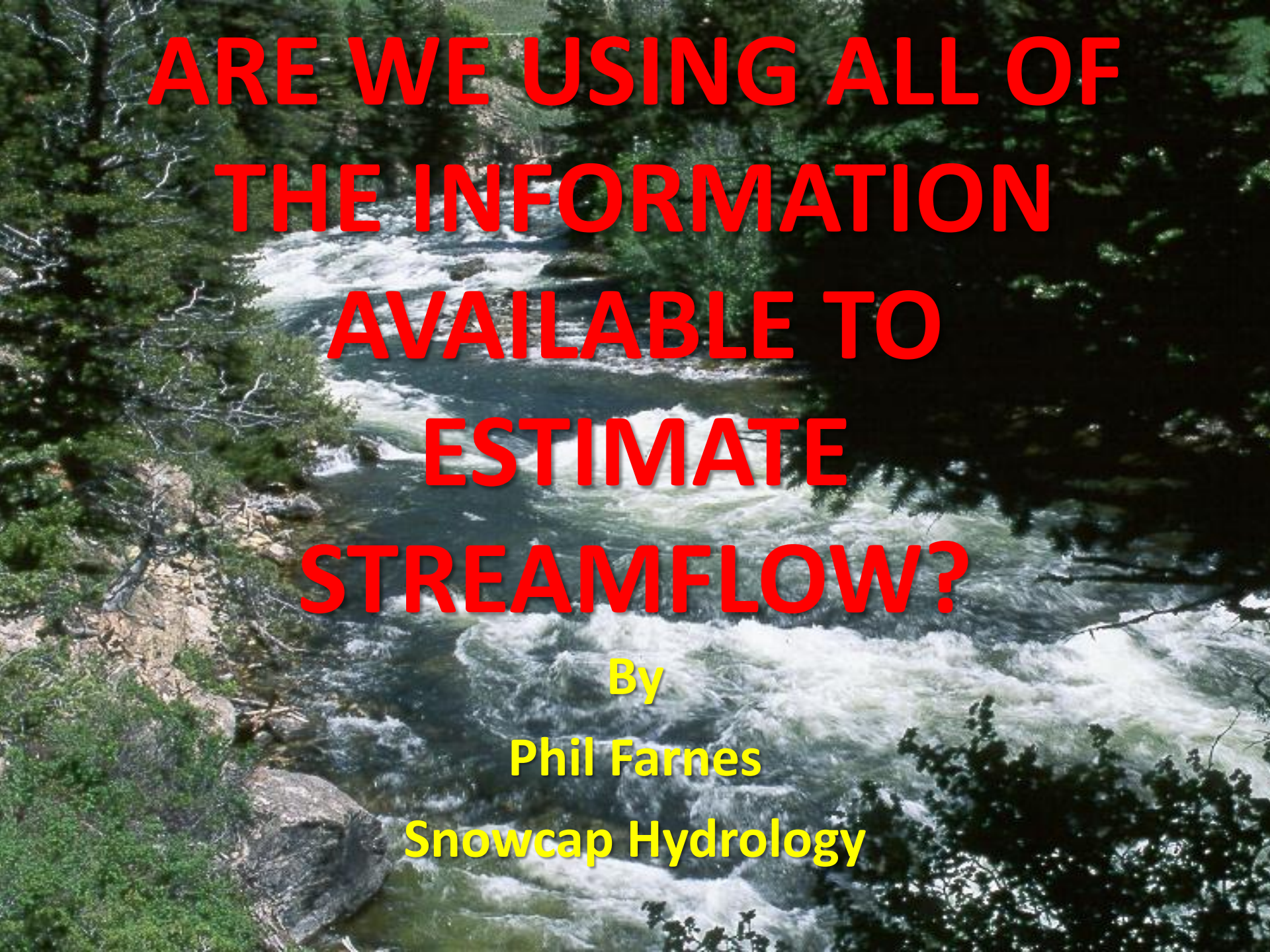


ARE WE USING ALL OF THE INFORMATION AVAILABLE TO ESTIMATE STREAMFLOW?

By

Phil Farnes

Snowcap Hydrology

DATA

- Need Complete Data Set
  - Get Missing Data Sheets
  - Estimate Missing Data
  - There Should Be One Dataset That Everyone Could Use

ONE PICTURE

- Presentation Of Data For Mountains And Valleys Need To Be Seamless
- The Days Of Them And Us Need To Be Part Of History

KBDI

- *Compute KBDI for both SNOTEL and Climatological Stations*
- *Provides Current Daily Status Of Soil Moisture*
- *Provides Precipitation Needed To Erase Deficit*
- *Used By Fire Managers*
- *Could Be Used By Many Disciplines*

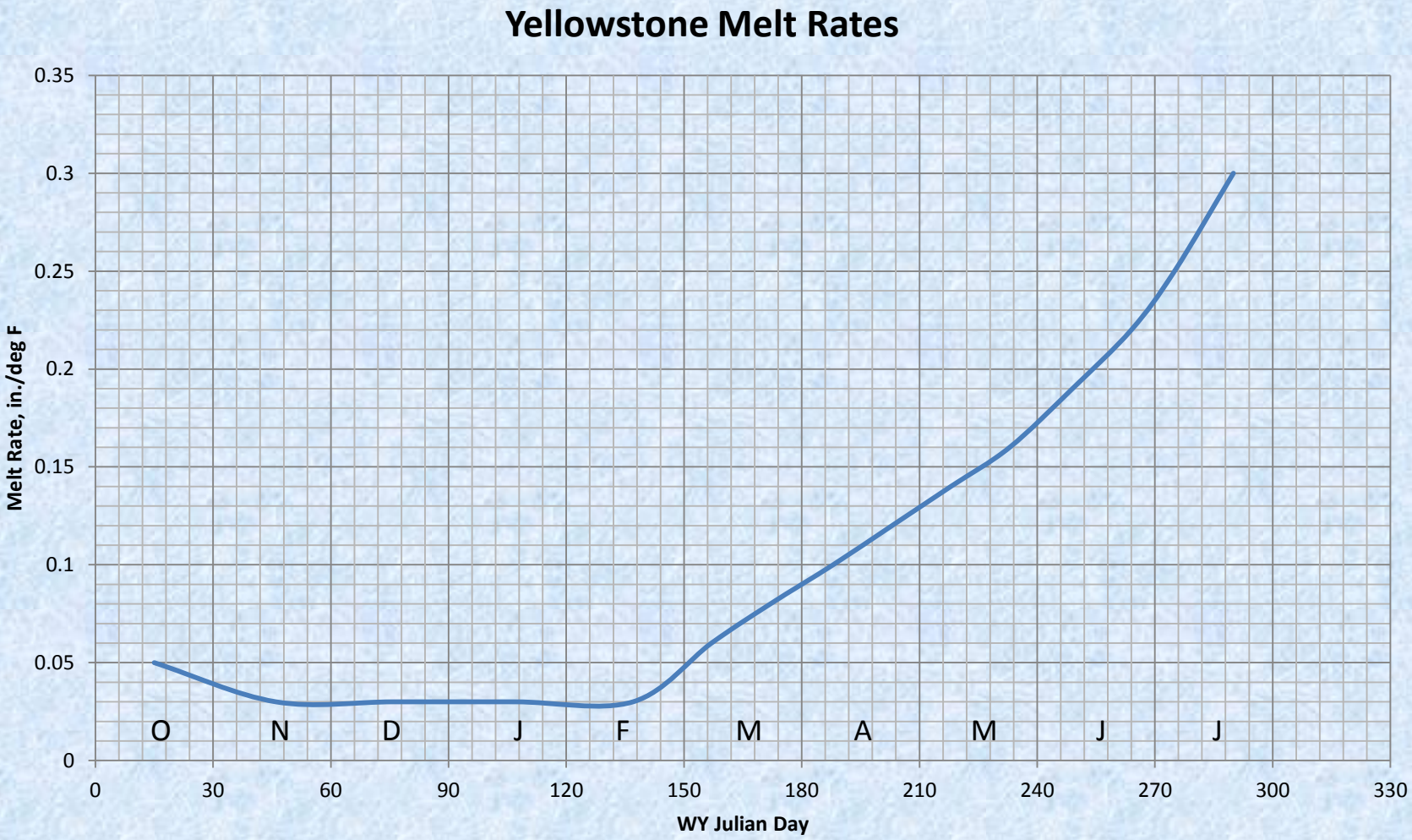
DATES

- **Hydrology Is Based On Phenological And Hydrologic dates, Not Calendar Dates**

MELT-RATES

- Temperature-Based Melt Rates Are Zero At TAVG Of 28 ^{0}F
- Melt-Rates Increase As Season Progresses

MELT RATES


Yellowstone Melt Rates
Melt Rate, in./deg F
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
30
60
90
120
150
180
210
240
270
300
330
WY Julian Day
O
N
D
J
F
M
A
M
J
J

INTERCEPTION

- Based on 19 Years of Record at Onion Park
  - Maximum Accumulation Of SWE On Canopy Pillow Is 76% Of Maximum Accumulation On Open Pillow
  - Melt Rate On Canopy Pillow Is 47% Of Open Pillow
  - Canopy Pillow Melts Out 10 Days After Open Pillow
  - Maximum SWE Occurs On Canopy Pillow 4 Days After It Does On Open Pillow

MODEL ADJUSTMENTS

- Many Montana Watersheds Are 70 to 80% Forested
- Data Sites Are Located In Open Areas
- Models Need To Account For Differences Between Open And Forested
- Different Species Have Different Interception
- Different Ages of Same Species Have Different Interception
- Temperature-Based Melt Rates Are Not The Same Through-Out The Season

NRCS SNOTEL DATA

- Data From SNOTEL Sites Is For Previous Day
- Adjustments Must Be Made For Daily Models

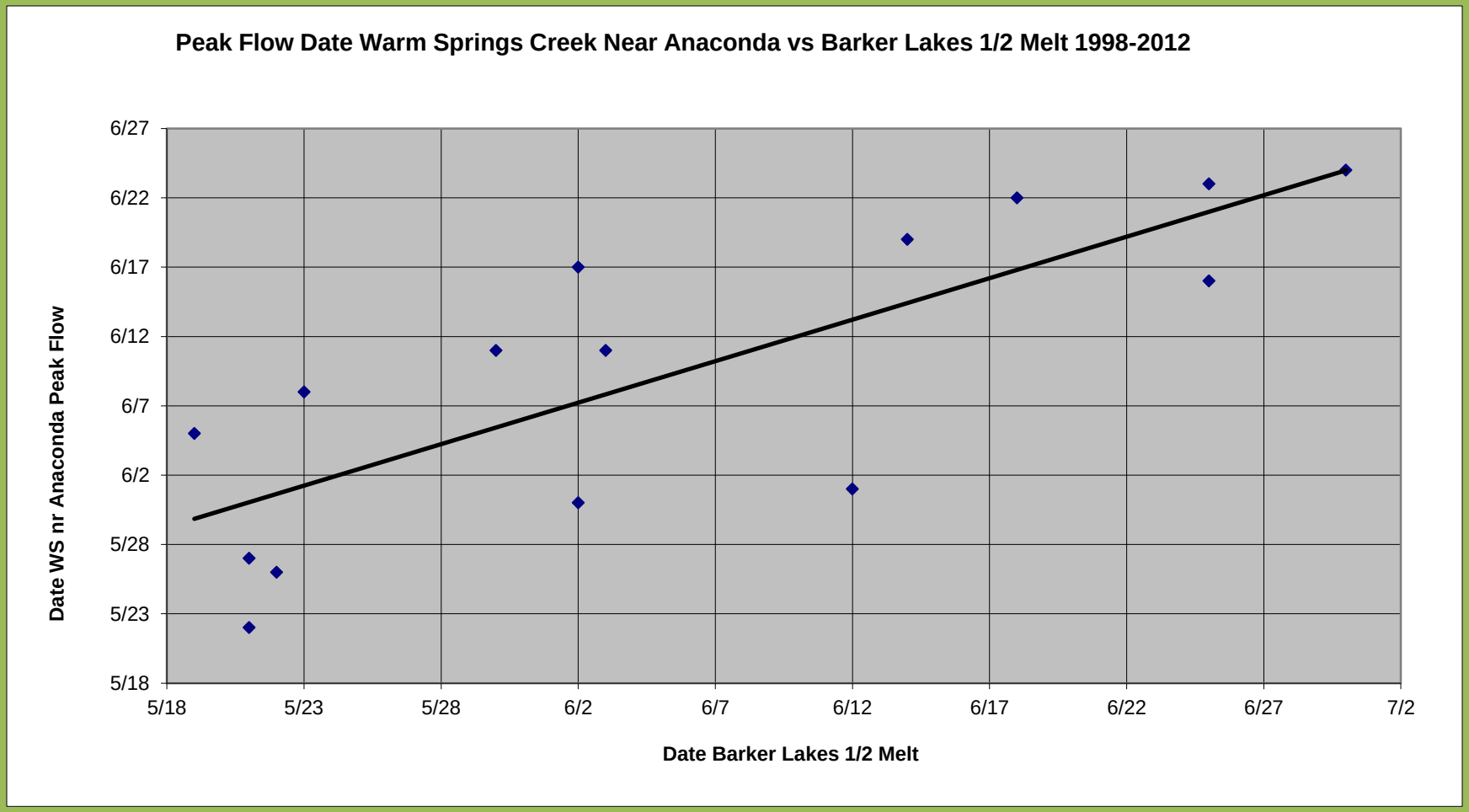
WSC PAPER

- Western Snow Conference 2007
- Estimating Runoff From Montana Steams
  - Average Annual Precipitation
  - Average April 1 SWE
  - Average April-July Precipitation
  - Cover Type
  - Fire History
  - HUC
  - Area By Precipitation Zone by Cover Type

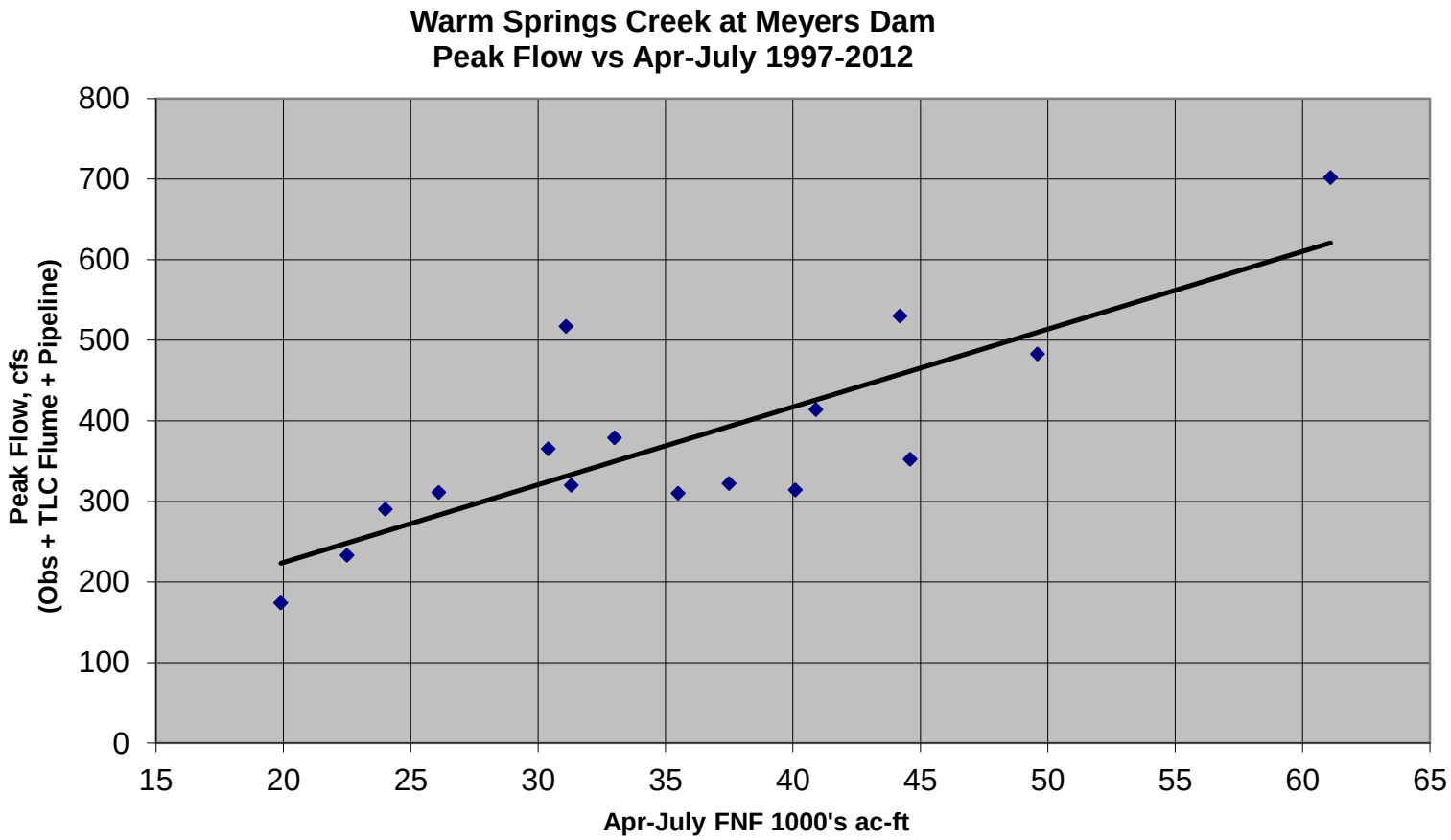
HALF-MELT

- Half-Melt Correlates With Peak Snowmelt
- Zero Melt for Lower Elevation Stations

HALF-MELT


Peak Flow Date Warm Springs Creek Near Anaconda vs Barker Lakes 1/2 Melt 1998-2012
Date WS nr Anaconda Peak Flow
6/27
6/22
6/17
6/12
6/7
6/2
5/28
5/23
5/18
5/18
5/23
5/28
6/2
6/7
6/12
6/17
6/22
6/27
7/2
Date Barker Lakes 1/2 Melt

PEAK DAILY FLOW



HIGH WATER

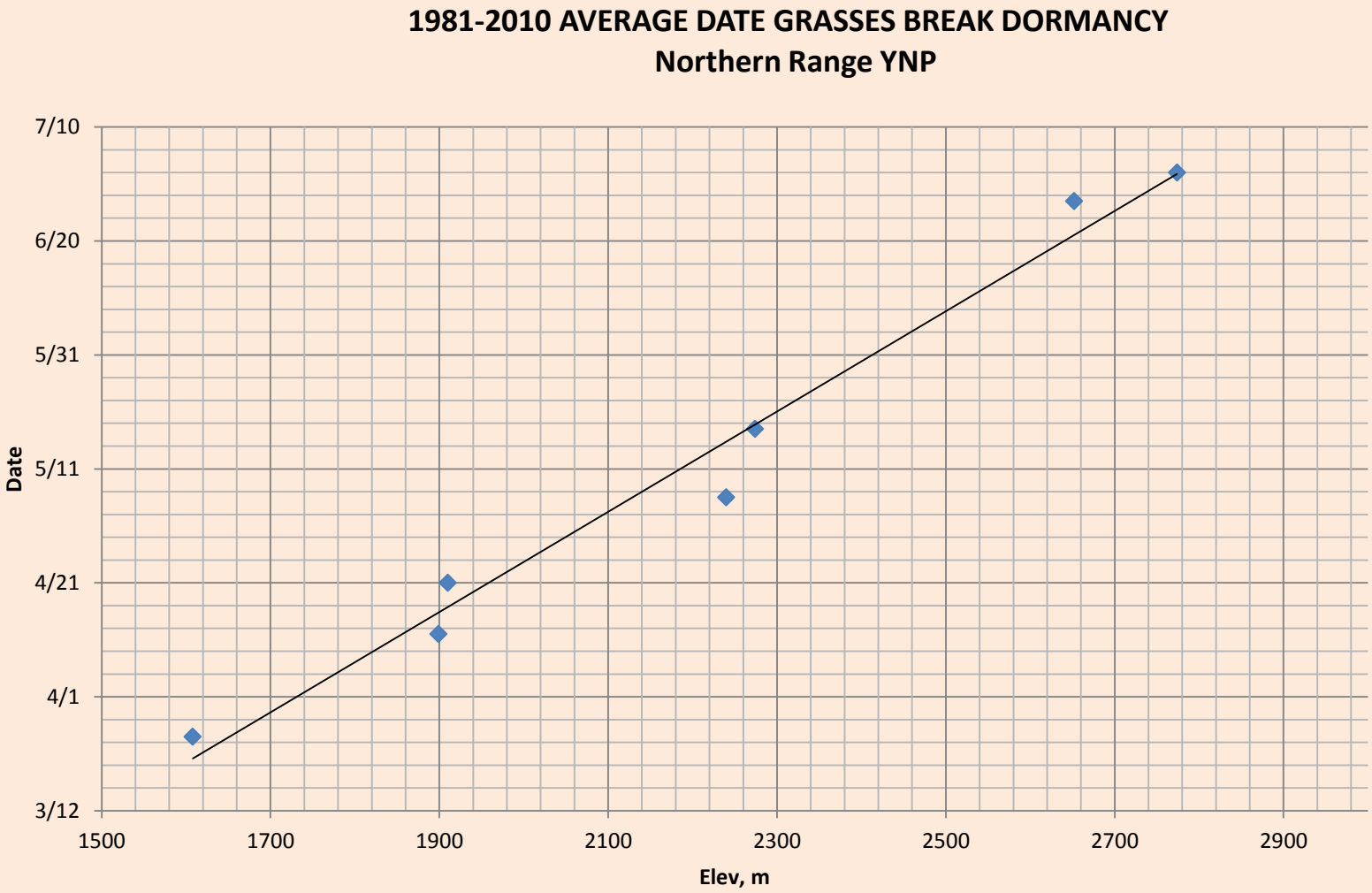
Native Americans Consider High Water To Be Over When Wild Roses are In Bloom

They Also Say That They Have Seen The Yellowstone River Dry At Livingston But The Gallatin River Always Has Water

GROWING DEGREE DAYS

- Biological Zero Considered To Be 41 ^{0}F
- GDD Equals Tavg Minus 41 ^{0}F
- Zero Or Negative Values Are Deleted
- Grasses Break Dormancy After Three Consecutive Days With Tavg above 41 ^{0}F and Snow Has Melted
- Trees Break Dormancy After Three Consecutive Days With Tavg above 41 ^{0}F
- Growing Season Ends When Tmin is 22 ^{0}F or Lower
- Growing Season Is Number Of Days Between Break Dormancy And End Of Growing Season
- Fall Green-up Important For Wildlife

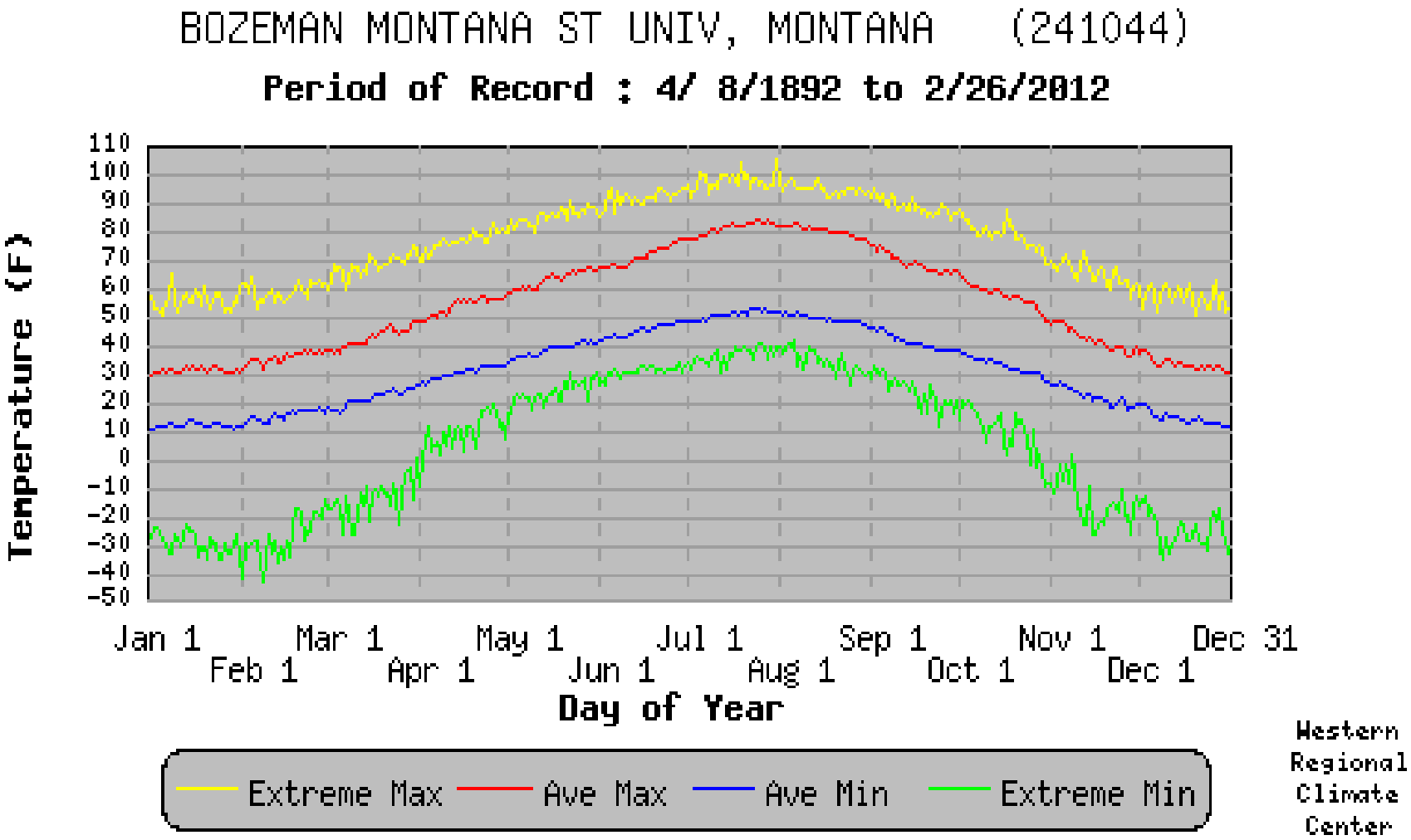
PHENOLOGY

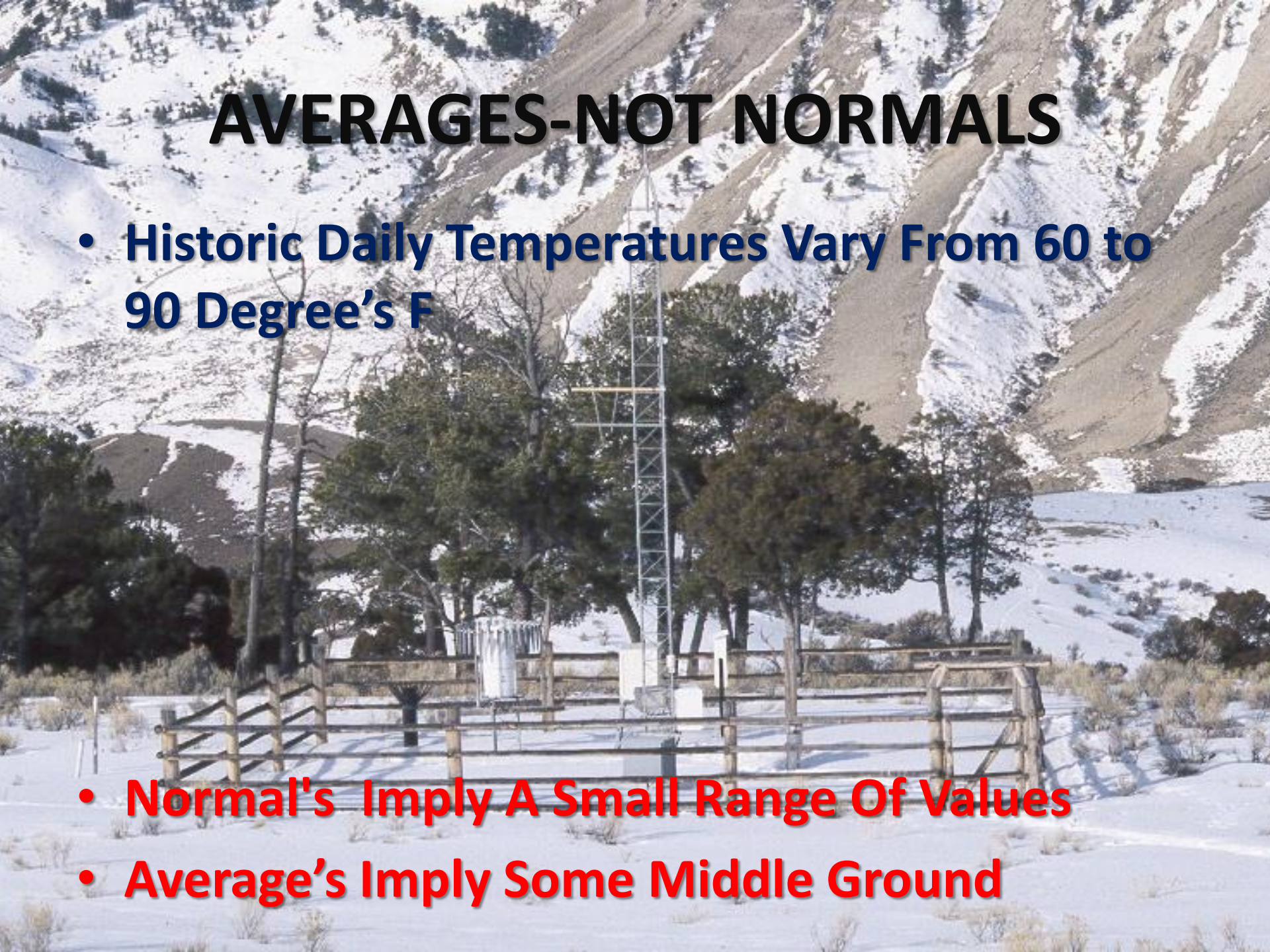

1981-2010 AVERAGE DATE GRASSES BREAK DORMANCY
Northern Range YNP
Date
7/10
6/20
5/31
5/11
4/21
4/1
3/12
1500
1700
1900
2100
2300
2500
2700
2900
Elev, m

SWSI - Drought

- Separate Index For Irrigated And Dryland
- Separate Irrigated From Natural Streamflow And Reservoir Storage

AVERAGES-NOT NORMALS

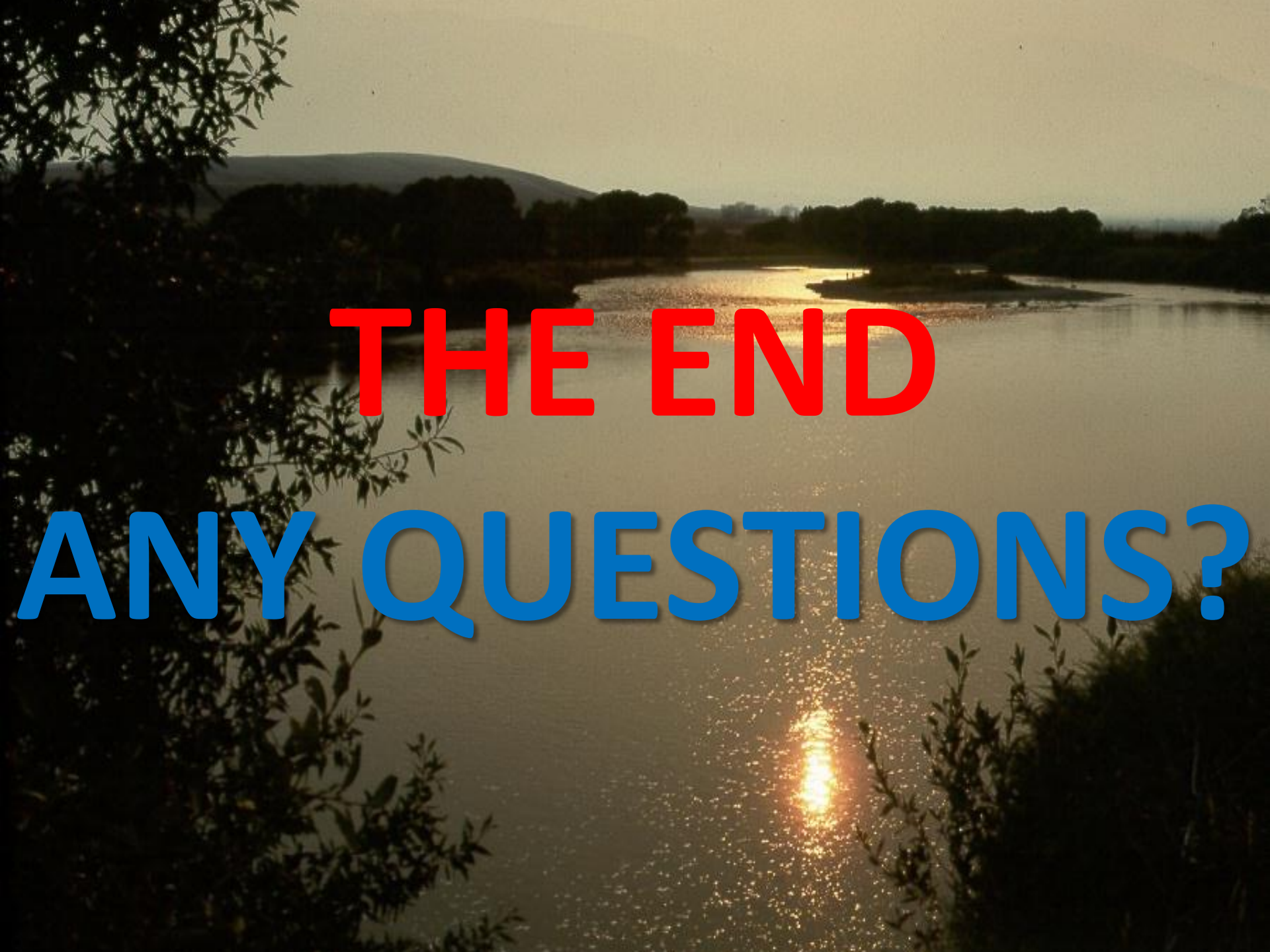




AVERAGES-NOT NORMALS

- Historic Daily Temperatures Vary From 60 to 90 Degree's F

- Normal's Imply A Small Range Of Values
- Average's Imply Some Middle Ground


THE END
ANY QUESTIONS?